RS - INT June 17, 1936

M - 1, R
WORKING PLAN
Wilting Coefficient
of soils

Miscellaneous

The Determination of the Wilting Coefficient of Granitic, ~~Gravelly~~ sandy Loam on Different Aspects by Phytometric and Mechanical Methods.

By T. E. Maki, Ass't Forester
and
E. L. Mowat, Ass't Silviculturist

Object: (General) To determine the wilting coefficient of granitic, ~~gravelly~~ sandy, loam by phytometric ~~means.~~ and mechanical means.

(Specific) What is the wilting coefficient of a granitic, sandy, loam from a (a) bench, (b) a north slope, and (c) a south slope, if measured at the wilting point of ponderosa pine seedlings? Does this "phytometric coefficient" agree with those arrived at by mechanical means.

Value of Study

The wilting coefficient of soils is generally determined by ascertaining the moisture equivalent and dividing this percentage by the Briggs and Schantz "constant" of 1.84, or the Hilgard cup maximum water retention capacity percentage by 2.90. Because these "constants" often yield values that do not even approximate the actual wilting point of soils and because the wilting coefficient of granitic soils such as occur in the Boise Basin country have probably never been determined, especially with relation to ponderosa pine reproduction, information on this point would prove extremely useful in connection with studies concerning pines in the seedling stage, whether in nature or in nurseries.

The study here outlined is intended to give some idea of the variability by aspects of the wilting point for ponderosa pine seedlings and, if possible, to arrive at more reliable constants for determining the coefficient by mechanical means.

Back ground of other work

It is assumed that no work has been done with ponderosa pine on granitic soils, so any reviews of past work are omitted here.

Scope of Study:

Species: Ponderosa pine

Locality: Slaughter house Gulch bench, south slope and north slope, Boise Basin Branch Experiment Station, Idaho City.

Extent: Essentially an out-door "laboratory" study employing pot technique.

Period of Study: June 15 to August 1, 1936.

Relation to Other Projects: A sub-division of the natural reproduction study on seed bed requirements.

Procedure:

Sampling of Soils:

Six samples of soil will be taken from each aspect, three from rodent-proof enclosure, three from non-rodent-proof. The samples spots will be mechanically spaced so the selection may be considered random. Sampling procedure will consist of removing the surface inch of soil to exclude debris and excess organic matter, taking a column of soil down to a depth of seven inches from this cleaned spot, mixing it thoroughly and filling each container (6" in diameter, 7" deep) brimful of soil.

Seed and Planting:

Ponderosa pine seed from the 1934 crop (Boise Basin Branch Station lot) will be used in this test. The seed has been in cold storage since the winter of 1934.

Random lots of eighty seeds will be assigned to each container, spread over the surface, and barely covered with soil.

Watering:

The cans will be placed in trays containing water, the moisture saturating the soil by capillary rise through the perforated bottoms. After the initial saturation, the soil be allowed to alternately dry by watering from the surface only, in order to stimulate better root development. When the seedlings are deemed sufficiently well developed, the soil will be again saturated by irrigation to insure more uniform moisture content, and then allowed to dry till the seedlings wilt.

Records:

Inspections will be made every five days to determine the progress of germination. Counts will be made during these inspections, and the number germinated and the number established recorded.

During the wilting period, daily counts will be made to determine the extent of wilting. If the wilting extends over a prolonged period, the can will be dismantled and moisture determination made when 95% of the seedlings have wilted in the can. This limit is only a tentative figure and may have to be modified for individual containers depending on the number of seedlings per can, and their behavior during wilting. The time from last saturation to wilting date will also be recorded.

Moisture Determinations:

On the day decided upon as the "wilting date" for any given container about 75 gram samples will be taken from each three different depths (a) surface, (b) center, and (c) bottom, and the total moisture determined by oven drying at 105° C for twelve hours or until constant weight is reached. If the roots of the wilted seedlings are in the zone of maximum moisture, that percentage will be chosen as the wilting coefficient.

Additional information on the soil in each container will include determination of the maximum water retention capacity by the Hilgard cup method, the moisture equivalent by the Briggs and Schantz method, and colloid percentage by the Cenco - Wilde method. An attempt will be made to correlate the wilting coefficients as actually found by phytometric means with those determined by the "constants" 1.84 for the Briggs and Schantz and 2.90 for the Hilgard cup methods. If these constants fail to yield results which are concordant with the phytometric coefficients, new constants, which indicate a more accurate wilting point for the granitic gravelly sandy loam under consideration will be computed.

Analysis of the Data:

The structure of the experiment is such that analysis of variance can be applied to determine significance of wilting coefficients, wilting rate, etc., between the three aspects involved in the study. It allows the following degrees of freedom as indicated in Table I.

Table I

ANALYSIS OF VARIANCE

Source of Variation	Degrees of Freedom	Sum of squares	Mean Square
TOTAL	17		
BETWEEN ASPECTS	2		
WITHIN ASPECTS	15		

The equations below illustrate the arithmetic necessary to arrive at the sum of squares.

(1) $$\frac{(\sum_{1}^{18} i)^2}{18} = C\ T$$ (Correction Term)

(2) $$\sum_{1}^{18} (i)^2 - C\ T =$$ Sum of Squares of Total variation.

(3) $$\sum_{1}^{3} \left[\frac{(\sum_{1}^{6} i_f)^2 + (\sum_{1}^{6} i_s)^2 + (\sum_{1}^{6} i_n)^2}{6} \right] - C\ T =$$ Sum of squares of between aspect variation.

(4) $$\sum_{1}^{18} (i)^2 - \sum_{1}^{3} \left[\frac{(\sum_{1}^{6} i_f)^2 + (\sum_{1}^{6} i_s)^2 + (\sum_{1}^{6} i_n)^2}{6} \right] =$$ Sum of squares within aspect variation

Correction analysis will be used to determine degree of harmony between coefficients derived by phytometric means and those derived by mechanical means.

LEGEND:

i_f = Individual values for flat

i_s = " " " south slope

i_n = " " " north slope

File Designation: RS - INT

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RESPONSIBILITY

PERSONNEL: . . . . . .Mowat and Maki

Probable Labor Requirements:

	time days	man days
Establishment	1	2
Maintenance For Entire Period	1	1
Records	1	1
Dismantling Field and Laboratory Work	2	4
Computations	2	2
Reports	1	1

Date of Completion:

Final report should be available by the end of September, 1936.